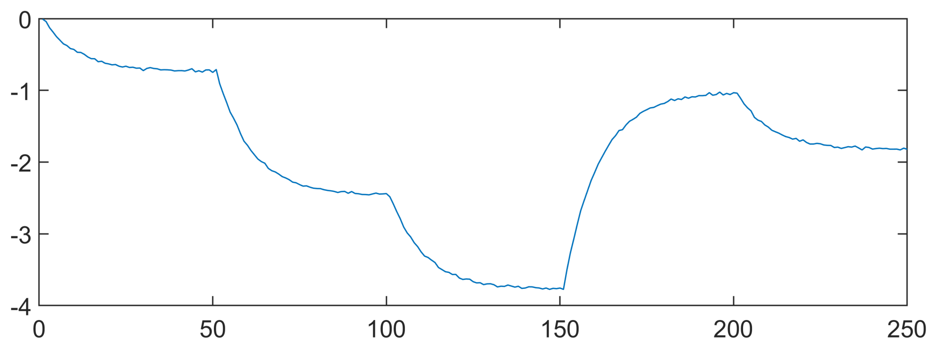
```
clear variables

load('lab8_1.mat')
```

```
Warning: Updating objects saved with previous MATLAB version...
Resave your MAT files to improve loading speed.
```

```

yid = id.y;
uid = id.u;
yval = val.y;
uval = val.u;
Ts = val.Ts;

figure,
subplot(211)
plot(yval)
hold on
```




```

% Stepsize
alpha = 0.5;
% Threshold
gama = 1e-4;
% Iteration range
lmax = 250;
% Initial parameter vector
theta = [1;1];
f = theta(1);
```

```
b = theta(2);
N = length(transpose(yid));

l = 1;
```

Computing recursion formulas and applying them to find Epsilon(k)

```
Epsilon_derivated = zeros(2,N);
Epsilon = zeros(1,N);
for k = 2 : 1 : N
    Epsilon_derivated(1,k) = yid(k-1) - f*Epsilon_derivated(1,(k-1)) - Epsilon(k-1);
    Epsilon_derivated(2,k) = -uid(k-1) - f*Epsilon_derivated(2,(k-1));
end

Epsilon_derivated_recursive = zeros(2,N);
```

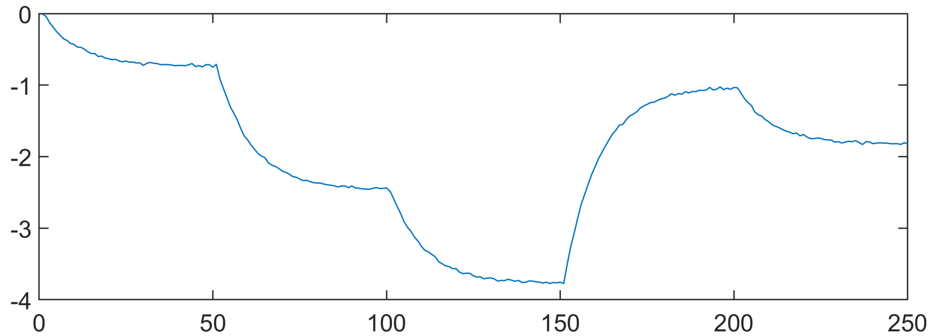
Repeat the steps below

until l reaches lmax or the norm between 2 consecutives theta terms is greater than gamma

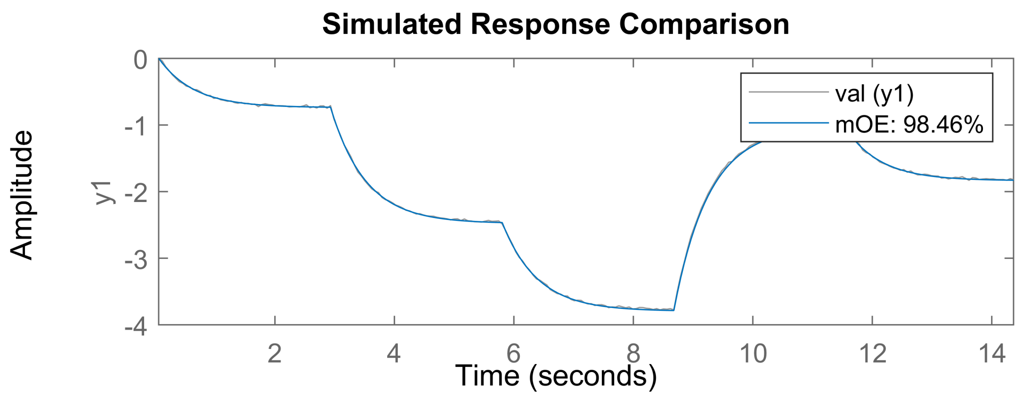
```
while ((l < lmax) || (norm(theta(:,l) - theta(:,(l-1))) > gama))

    for k = 2 : 1 : N
        Epsilon(k) = yid(k) + theta(1,l)*yid(k-1) - theta(2,l)*uid(k-1) - f*Epsilon(k-1);
        Epsilon_derivated_recursive(1,k) = yid(k-1) - theta(1,l)*Epsilon_derivated_recursive(1,
        Epsilon_derivated_recursive(2,k) = -uid(k-1) - theta(1,l)*Epsilon_derivated_recursive(2
    end
    % Compute gradient of the objective function
    gradient_sum = 0;
    for k = 1 : 1 : N
        gradient_sum = gradient_sum + Epsilon(:,k)*Epsilon_derivated_recursive(:,k);
    end
    dV_dtheta = 2*gradient_sum / N;
    % Compute approximate Hessian of the objective function
    hessian_sum = 0;
    for k = 1 : 1 : N
        hessian_sum = hessian_sum + Epsilon_derivated_recursive(:,k)*transpose(Epsilon_derivate
    end
    H = 2*hessian_sum / N;
    % Apply Gauss-Newton update formula
    theta(:,(l+1)) = theta(:,l) - alpha*inv(H)*dV_dtheta;
    % Increment the counter
    l = l+1;

end
```

Plot the results

```
subplot(212)
mOE = idpoly(1,[0 theta(2,end)],1,1,[1 theta(1,end)],0,Ts);
compare(val,mOE)
hold off
```



0
-1
-2
-3
-4
0
50
100
150
200
250



Simulated Response Comparison
Amplitude
y1
0
-1
-2
-3
-4
2
4
6
8
10
12
14
Time (seconds)
val (y1)
mOE: 98.46%